4.4 KENNEDY CREEK CHECK AND WASTEWAY

4.4.1 Structure Overview

The Kennedy Creek check and wasteway structure (Figure 4.4.1) is one of two wasteways located along the 29-mile canal. It is located about 1,000 feet downstream along the canal from the Kennedy Creek siphon (Figure 4.0) and serves primarily as an emergency discharge point should Kennedy Creek breach or overtop the canal prism. The wasteway also serves as a drain for off-season inflows. The structure is located such that the wasteway appears to discharge into a previous channel of Kennedy Creek.

Figure 4.4.1 Upstream view of Kennedy Creek check structure. Wasteway is located at right side of photo (10/13/04).

The check portion of the structure is approximately 29 feet wide and 11.5 feet high with three radial gates. Each of the gates is 9 feet wide and 10 feet high. The gates are wood-faced and do not appear to have been operated in a long time. The gates are secured in the open position with chains to lock them open. This may be a safety measure to prevent unauthorized operation or accidental closure if the operating cables failed. The check structure slab is about 20 feet long and has hand laid rip rap extending upstream and downstream from the structure.

The wasteway portion of the structure is depressed 2 feet below the bottom of the check structure. The wasteway has an overall height of 13.5 feet and an overall width of about 13 feet. The structure contains two 6 ft. x 6 ft. radial gates of similar construction as the check structure. Only one gate appears to be operable. The second gate appears to have wooden wedges driven between the gate and concrete sidewall to minimize leakage around the perimeter. The face of each gate has been covered with a plastic membrane over the wood face to further reduce leakage. The plastic is deteriorating. The concrete base of the structure is about 11 feet long. Concrete wing walls and a slab extend about 20 feet downstream. Hand-laid rip rap is placed both upstream and downstream of the structure.

4.4.2 Existing Conditions and Deficiencies

Check Structure

The concrete structure overall is in fair to poor condition. The channel divider walls between the gates and the abutment wall have many areas of deteriorated concrete. Past concrete repairs are apparent and generally appear to be holding.

The wooden gate faces are badly deteriorated. Each gate is equipped with a mechanical hoist and cable system to raise and lower the gate. The cables have worn grooves in the wood face of the gates. The gates are chained so that they cannot close without removing the chain. BOR studies indicate that the gates are inoperable. Their deteriorated condition makes it probable they would perform poorly if they were operable. Hand-laid rip rap upstream and downstream of the structure appears in good condition.

Wasteway

The concrete on the wasteway portion of the structure is in a much more deteriorated condition. There is significant spalling and reinforcing steel exposed in each of the raceways above the low water line. The downstream walls and center wall are also in poor condition. The top slab is extremely deteriorated and can no longer support the reaction thrust produced by the gate operators. Steel beams have been placed beneath the operator for the only operable gate to support the gate reaction load (Figure 4.4.2).

Figure 4.4.2 Upstream view of Kennedy Creek check structure (left) and wasteway (right). Note modifications to wasteway operator slab to maintain operation (11/11/04).

Figure 4.4.3 Upstream view of wasteway. Note condition of concrete. Wasteway is open during off-season to drain inflows and seepage (11/11/04).

The other gate has wood wedges driven around the perimeter in an attempt to seal it and doesn't appear operable. The faces of both gates have been covered with plastic since the wood is deteriorating.

Figure 4.4.4 Downstream view of wasteway (11/11/04).

Operation and Safety

Both the check structure and the wasteway structure pose substantial safety hazards to operating personnel. There are no handrails or other fall protection measures around the structures. Operating mechanisms have only small access areas with no fall protection.

Only one of the wasteway gates appears operable. The main check gates are in poor condition and are inoperable.

The check and wasteway are primarily used for emergencies to control excess canal flows. However, the structures lack instrumentation, automation or remote-control capabilities. The single gate of the wasteway is the only operable component of the combined structure. Access to the structures may be limited during an emergency.

4.4.3 Rehabilitation Alternatives

The Kennedy Creek check structure concrete has been repaired in the past and could be serviceable for a while. The gates, however, are not usable. Since the check structure protects the downstream portion of the canal from flooding, the existing structure poses risk to this reach. A new structure with power actuated gates and a radio telemetry and supervisory control and data acquisition (SCADA) system is recommended. An operating wasteway is an integral part of the check and control system.

Alternatives to be evaluated for the check structure involve (1) gate type and size; (2) structure location, and (3) construction integral or separate from the wasteway structure. The structure is currently located on an old channel of Kennedy Creek and downstream of the Kennedy Creek siphon. This siphon will have less flexibility in passing unexpected high flows than the rehabilitated canal channel. As such, placement of the check or wasteway above the siphon may be more desirable than its current location. The existing location, however, may provide additional downstream canal protection if Kennedy Creek were to breach the canal dikes. This would favor separating the wasteway and the check structure or adding a second relief wasteway.

The Kennedy Creek wasteway structure is contiguous with the check structure. Only one of the two radial gates is operable and the concrete on this structure is badly deteriorated. Repair of this structure is impractical. The structure also lacks basic safety features to protect the operator from falls while operating the gate.

Alternatives for replacement involve (1) gate type and size; (2) structure location; and (3) construction integral or separate from the check structure. The structure currently discharges into an old channel of Kennedy Creek, but relocation upstream of Kennedy Creek may be beneficial to the overall protection of the Kennedy Creek siphon and canal. An analysis of costs and benefits would be beneficial. A SCADA type control system to automatically control this emergency component is essential to protecting the canal system.

The BOR recommends replacing these structures with a new system slightly upstream of its present location. The recommendation is for a new check with three radial gates 10 ft. x 10 ft.

each and a wasteway with two sluice gates 6 ft. x 6 ft. each. In our opinion, use of overshot gates in the check and wasteway structures warrants further consideration. This type of gate system has been used successfully in Canada on similar canals. An example of an overshot gate check structure is shown in Figure 4.4.5. The main disadvantage of a radial gate, especially in a check structure, is that they fail in a closed position. The BOR does not include automation in their alternatives or cost estimates but do indicate that the new structures should be designed to allow for automation in the future.

Figure 4.4.5 Typical check structure equipped with overshot style gates.

4.4.4 Estimated Rehabilitation Costs

BOR estimated project costs for the radial arm check vary from $900,000 to $1,160,000 and from $530,000 to $560,000 for the sluice-gated wasteway, depending on the design flow. The cost estimates are dated March 2003 and do not include automation. It is not clear whether the contingencies include Tribal fees (5%). A discrepancy was noted in the 850 cfs design summary report. The summary table on page 16 of the BOR report lists the costs for the 850 cfs sluice-gate wasteway as $560,000, but the supporting worksheet in the Appendix indicates a cost of $420,000. For budgetary purposes, the larger amount was used.

We have updated the BOR cost estimates in the table below to reflect automation ($25,000 for each component), a 2007 construction season (1.1255 factor) and Tribal fees (5%).

Table 4.4.1 Cost Estimates to Rehabilitate Kennedy Creek Check and Wasteway Structures

Canal Capacity	BOR Cost Estimates - 2003		Projected Costs - 2007[1]	
	New Check	New Wasteway	New Check	New Wasteway
500 cfs	$900,000	$530,000	$1,089,900	$652,600
670 cfs	$970,000	$560,000	$1,172,600	$688,000
850 cfs	$1,040,000	$560,000	$1,255,300	$688,000
1000 cfs	$1,160,000	$560,000	$1,397,100	$688,000

(1) = [(BOR Costs * 1.1255) + $25,000] * 1.05

4.4.5 Rehabilitation Schedule

The existing inoperative structure poses some additional flooding risk to the downstream canal. Since one of the existing wasteway gates is still operable, there is still some ability to control flooding downstream even without the check structure. Canal operating personnel utilize a conservative operating procedure and reduce flows from the river into the canal when major storms are predicted. In general, check structures that must be visited and manually controlled, provide limited flood protection during an emergency. Automated gates provide a much greater level of protection. This structure poses a medium risk to the system and would have a lower priority than several other components of the system.

This replacement project would have a medium priority similar to that of Kennedy Creek siphon structure. Although it is important to the safety of the system, it can be utilized for a few more years. Some repairs of the gate and safety fencing for fall protection should be provided in the near future.

These components are within the canal and must be completed in the off-season unless the canal is proposed to be rerouted or can be rerouted to the new check/wasteway structures. Construction during the summer season is preferred.

Table 4.4.2 Estimated Time to Rehabilitate the Kennedy Creek Check and Wasteway Structures

Task	Duration
1) Feasibility Study	2 months
2) Final Design	4 months
3) Construction Phase	12-14 months
TOTAL TIME	18-20 months

4.5 ST. MARY AND HALLS COULEE SIPHONS

4.5.1 Structure Overview

St. Mary River Siphon

The St. Mary River Siphon is one of the most significant features of the 29 miles of the St. Mary River Diversion Facilities. The inverted siphon consists of two riveted steel pipes ranging in diameter from 84 to 90 inches. The 90-inch pipe transitions to an 84-inch diameter as it crosses the St. Mary River Bridge and then back to 90 inches (See Figures 4.5.1 and 4.5.2). The overall siphon length varies from reported lengths of 3,205 to 3,230 feet long. The original wall thickness of the pipes varies from 1/4-inch to 3/8-inch, depending on its location. The discharge capacity of each pipe is 425 cfs for a combined capacity of 850 cfs. Water velocities range from 9.63 to 11.05 fps for the two different diameters. The maximum static head is 165 feet (71.5 psi) which is the elevation difference between the inlet water level and the center of the pipes crossing the bridge. The siphon inlet and outlet are concrete transition structures (Figures 4.5.3 and 4.5.4).